Waveplates from PEN

Thin, highly birefringent, polyimide (PI) foils are used in waveguide components as half waveplate to compensate for waveguide birefringence effects. The waveplates are inserted in a slot in the waveguide and divides it in two equal optical pathlenght sections. If the waveplate axis is at 45 degrees with the TE or TM direction (in plane or out of plane), the TE and TM polarizations are rotated by 90 degrees. The TE transfers to the TM and v.v. Their dominant use is in AWG components,see: IEEE JLWT, vol. 15, no. 10, Oct.1997, pp. 1947-1957. This is commercially a very important product and JDSU considers the use of this in their AWG's.

The attractiveness of the PI foils is their environmental and mechanical stability, in addition to their small thickness (~15 micron). The latter yields limited diffraction loss in the waveguide slots. The small thickness is made possible by the high birefringence (Δn~0.05) in the polymer plane. For half-wave retardation at a wavelength of 1550 nm the product of thickness and birefringence should be 0.5x 1.55=0.775 micron. These waveplates are commercially available from NTT. However their price is high. According to NTT, this is to cover for license fees on the patent that they hold on the PI waveplate and its production. See: US patent 5,901,259 of May 4, 1999. Alternative polymeric materials are mentioned in this document but all these have severe drawbacks. Not mentioned is the material polyethylenenaphtalate (PEN). This material seems to combine good environmental and mechanical stability with high birefringence too. The first can be derived from the datasheets of the commercial producer (Teijin/Dupont) of this foil (see http://www teijin.co.jp). The latter can be derived from the literature; in Adv. Mater. 1988,10, no 12, pp.934-938 its use in linear polarizers is described. The publication shows a graph of the in plane birefringence as a function of polymer stretching is plotted. An extremely high birefringence of > 0.1 can be obtained upon stretching by a factor of 2x. Thinner half waveplates than in PI are therefore feasible in this material.

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Specification as originally filed, with Application for Patent Serial No: **2,315,997**, on August 15, 2000 by **JDS UNIPHASE INC.**, assignee of Mart Diemeer for "Waveplates From pen".

S. Grégoire
Agent certificateur/Certifying Officer

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Date

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